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The Transportation of Fine Arts Materials
Aboard the Space Shuttle Columbia

G.A.S. Payload #481

VERTICAL HORIZONS

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ABSTRACT

The Vertical Horizons experiment represents an initial investigation into the transportation of fine arts materials aboard a Space Shuttle. Within the confines of a G.A.S. canister, artist quality fine arts materials were packaged and exposed to the rigors of space flight in an attempt to identify adverse effects.

INTRODUCTION

Currently, little experimentation is being done in assessing the hazards of transporting fine arts materials aboard a Space Shuttle. This initial experiment will provide a foundation upon which additional data may be compiled in order to safely transport objects of visual art into space.

Contained inside our G.A.S. canister (see Figure 1) were samples of linen canvas in three states: raw, primed and painted, which were concentrically rolled in polyurethane foam. On the painted portions of the experimental samples we chose to create actual paintings with a wide variety of pigments rather than patches and painted strips in order to exemplify the type of artistic materials which may be used in future space environments. In the center of the canister we installed a **Tattletale™ Thermograph**, furnished by the **Onset Computer Corporation**. This instrument was intended to record temperature changes inside the G.A.S. canister at hourly intervals. Throughout the mission, pressure in the canister was maintained at one atmosphere.

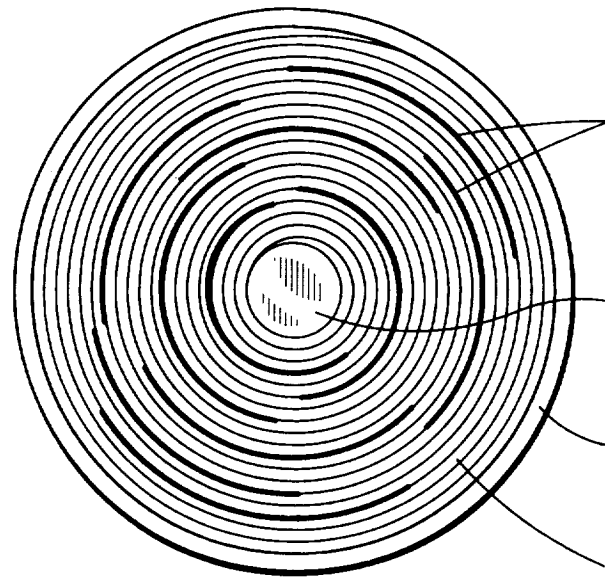
Our intention was to identify any accelerated degradation in the experimental samples caused by the cumulative effects of vibration, temperature change, zero gravity and G-force stress resulting from Space Shuttle flight.

PROCEDURE

The following is a list of materials selected for use in this experiment:

- A. Three 16 x 12 inch samples of unprimed Belgian linen (UP1)
- B. Three 16 x 12 inch samples of single-primed Belgian linen (SP1)
- C. Three 16 x 12 inch samples of double-primed linen (DP1)
- D. Three 19 x 15 inch samples of single-primed Belgian linen painted with oil colors (SPP1)

TOP



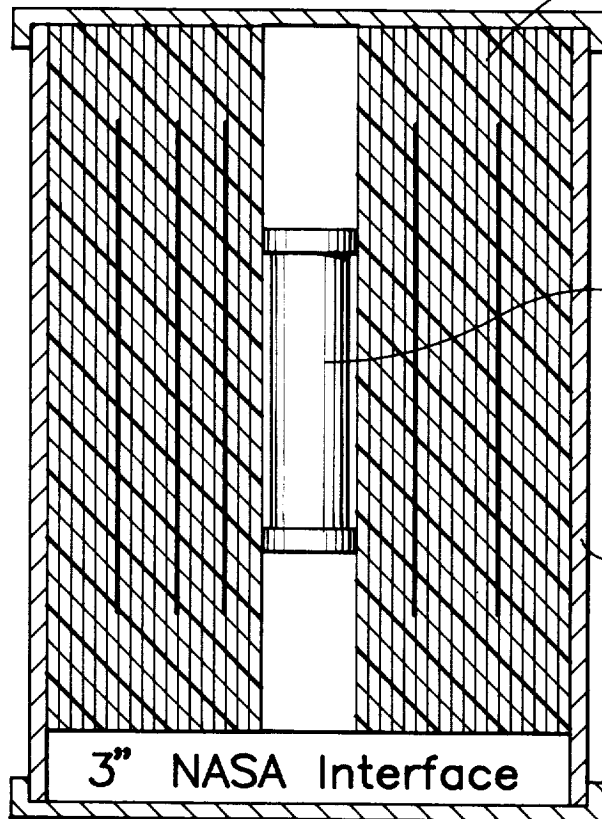
Experimental Samples
(spaced 10" apart)

Thermograph

G.A.S. Canister

Concentric
Layers of
Polyurethane

VERTICAL
CROSS
SECTION



Thermograph

G.A.S. Canister

3" NASA Interface

G.A.S. Payload #481
Vertical Horizons

- E. Three 19 x 15 inch samples of double-primed Belgian linen painted with oil colors (DPP1)
- F. Tattletale™ Thermograph: 2 inch diameter x 9 inch length, powered by 4 AA alkaline cells
- G. One roll of polyurethane packing foam

Prior to containment in the G.A.S. canister, oil colors were applied with traditional artist methods to the 19 x 15 inch samples of single-primed and double-primed canvases. These samples were examined by the conservation department of the Julius Lowy Frame and Restoring Company, Inc. in New York City. The following examinations were performed:

- A. Visual
- B. X-ray
- C. Ultraviolet
- D. Solvent tests with acetone and toluene

Upon completion of the examinations, a random selection process was undertaken to determine which samples would be placed into the G.A.S. canister and which samples would remain on Earth as controls. The samples were marked and recorded. The samples selected for placement aboard the Space Shuttle were concentrically rolled between layers of polyurethane foam. The materials were placed in the G.A.S. canister for transportation to the Kennedy Space Center. Upon arrival at K.S.C. the experimental samples were removed from the shipping canister and placed into a 5 cubic foot G.A.S. flight canister. The thermograph was inserted into the center of the concentrically rolled polyurethane foam. The canister was sealed and purged with dry air. The canister was placed onboard the Space Shuttle Columbia for flight STS-61C. The mission lasted just over six (6) days, at which time the canister was returned to K.S.C. from the Edwards Air Force Base.

Upon recovery of the G.A.S. canister from K.S.C., the experimental samples were removed and subjected to re-examination using the previously noted methods.

RESULTS

Following examination and testing of the experimental and control samples (see condition reports), a comparison of the test results demonstrated the following:

- A. The linen and painted surfaces showed no signs of oxidation.*
- B. The surfaces showed no accumulation of foreign substances.
- C. The surface layers were fully intact with no evidence of cracking,* or flaking* of the pigments.
- D. There was no sign of cupping* or cleavage.*

Temperature changes within the G.A.S. canister were not recorded due to an error in the programming of the thermograph.

CONCLUSIONS

When fine arts materials are transported in the method adhered to in this experiment, no sign of degradation is apparent. We may therefore conclude that materials of the fine arts can be transported for limited periods of time into space and returned safely.

*refer to Glossary for definitions

FUTURE PLANNING

Mankind has migrated to and colonized most of the habitable land mass on Earth and wherever he has chosen to live, he has brought art with him or created it anew. Our research represents a first step in the safe transportation of art into man's newest frontier, Space.

Taking this into consideration, future experiments may focus their examinations on the following:

- A. The effects of long duration flights.
- B. Exposure of the materials directly to the space environment.
- C. Transportation of other cultural items (i.e., sculpture and mixed media).
- D. Development and transportation of materials to be used in creating new items of cultural value in space.

We fervently hope that projects such as ours will inspire a global consciousness and demonstrate that the peaceful use of space is essential if we are to make space exploration a productive venture for mankind.

ACKNOWLEDGEMENTS

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GLOSSARY

1. Abrasion: "Pictures are subject to all kinds of abrasions... Scratches occur most frequently when the picture is being transported. A single scratch on a precisely gradated painting can be disastrous."
2. Cleavage: "A painting develops cleavage when the support contracts resulting in the loss of bond between the ground and support or laminated layers of the paint. Cleavage or buckling is not always visible in the early stages. The loss of adhesion may at first appear as a slightly inflated air pocket rising from the paint surface."
3. Cracking: "Some (paintings) develop cracks more quickly than others depending upon the soundness of construction and the judicious choice of material. Prolonged movement, instability of the support or inadvertant pressures cause disfiguration... Changes of temperature and environment can cause the support to expand and contract producing cracks that penetrate through the ground to the paint... Allowed to continue, the stress of movement produces a widening of the cracks and further splitting."

4. Cupping: "A curling or cupping of the paint may accompany the cleavage as a result of further stress in the support. Intersecting cracks form small islands in the paint film and the loss of adhesion causes the paint to curl upwards."
5. Flaking: "The movement and stresses of the support are instrumental in cracking and cleavage of the layers, causing the paint to lose bond and become detached. This condition is called flaking."
6. Oxidation: "Oxidative breakdown of the paint medium leads to weight loss and this has been used to measure the rate of oxidation which is normally associated with cracking due to the erosion of the (paint) film surface."

Reference: Kelly, Francis, Art Restoration: A Guide to the Care and Preservation of Works of Art, McGraw-Hill Book Company, New York (1972).

CONDITION REPORT #1

Sample #'s Control and Exp. Samples (UP1)
(SP1)
(DP1)

Date: 4/14/87

Artist: Size in inches: 16 x 12

Medium: Unpainted Canvas Size in cm. : 40.6 x 30.5

Surface Coating: ___ Varnished X Unvarnished

Paint film: Medium is characteristic of no paint film

Conditions:

No Discoloration: fading, yellowing, blanching, grime, darkening, dirt

No Cleavage: flat cleavage, buckled or cupped

No Embrittlement: flaking, chipping, paint of ground loss

No Cracking: paint and/or ground cracking

No Damages: abrasions, punctures, tears, dents

___ Additional observations:

Yes Condition sound

Support:

Canvas: Belgian linen in various states of preparation

X Observations of condition: Excellent

Examinations performed:

X Visual

X Ultra-violet light

X X-rays

___ Solvent tests: _____

CONDITION REPORT #4

Sample #'s Control and Exp. Samples (SPP1)
(DPP1)

Date: 4/24/87

Artist: Ellery Kurtz

Size in inches: 19 x 15

Medium: Oil on linen canvas

Size in cm. : 48.3 x 38.1

Surface Coating: Varnished Unvarnished

Paint film: Medium is characteristic of oil paints

Conditions:

No Discoloration: fading, yellowing, blanching, grime, darkening, dirt

No Cleavage: flat cleavage, buckled or cupped

No Embrittlement: flaking, chipping, paint or ground loss

No Cracking: paint and/or ground cracking

No Damages: abrasions, punctures, tears, dents

Additional observations: No sign of oxidation

Yes Condition sound

Support:

Canvas: Belgian linen with single and double coat of alkyd priming

Observations of condition: Excellent

Examinations performed:

Visual

Ultra-violet light

X-rays

Solvent tests: Toulene and acetone
